



Serial No. 09/694,701

PATENT
1956-045 (81841.0049)

Listing of Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1(withdrawn) A method of making an assay article for use in biopolymer detection comprising the steps of:

- (a) providing a biopolymer;
- (b) providing a modified substrate; and
- (c) contacting the biopolymer with a surface of the substrate under a condition sufficient for a direct adsorption of the biopolymer on the surface of the substrate.

Claim 2 (withdrawn) The method of claim 1, wherein the biopolymer is unmodified prior to the contacting step.

Claim 3 (withdrawn) The method of claim 1, wherein the biopolymer is modified prior to the contacting step.

Claim 4 (withdrawn) The method of claim 1, wherein the substrate is selected from the group consisting of organic polymers, their analogs, blends and copolymers selected from the group consisting of polycarbonates, polyethylenes, polypropylenes, polymethacrylates, polymethylpentenes, polysulfones, polytetrafluoroethylenes, and polyvinylidene difluorides.

Claim 5 (withdrawn) The method of claim 4, wherein modified substrate is aminated polypropylene.

Claim 6 (withdrawn) The method of claim 1, wherein the substrate is in a form selected from the group consisting of: foams, filaments, threads, sheets, films, slides, gels, membranes, beads, plates, and like structures.

Claim 7 (withdrawn) The method of claim 1, wherein the contacting step is carried out by a technique selected from a group consisting of: jet printing, solid or open capillary device contact printing, microfluidic channel printing, silk screening,

printing using devices based upon electrochemical or electromagnetic forces, and manual spotting.

Claim 8 (withdrawn) The method of claim 1, wherein the biopolymer is selected from a group consisting of: nucleic acids, polypeptides, proteins, and analogues thereof.

Claim 9 (withdrawn) The method of claim 8, wherein the biopolymer is a polynucleotide.

Claim 10 (withdrawn) The method of claim 9, wherein the polynucleotide is cDNA.

Claim 11 (withdrawn) The method of claim 1, wherein the step of providing the biopolymer comprises providing a solution of the biopolymer; and the step of contacting comprises:

- (a) placing an aliquot of the biopolymer solution on the modified substrate; and
- (b) air-drying the substrate to directly adsorb the biopolymer on the surface of the substrate.

Claim 12 (withdrawn) The method of claim 11, wherein the modified substrate is an amino-modified substrate.

Claim 13 (withdrawn) The method of claim 12, wherein the amino-modified substrate is aminopolypropylene.

Claim 14 (withdrawn) The method of claim 11, wherein the amount of the biopolymer applied to the substrate ranges from about 10^{-20} to about 10^{-14} moles.

Claim 15 (withdrawn) The method of claim 14, wherein the biopolymer is a polynucleotide, and the amount of polynucleotide is about 10^{-18} moles.

Claim 16 (withdrawn) The method of claim 11, wherein the aliquot is from about 0.1 nL to about 500 nL.

Claim 17 (withdrawn) The method of claim 16, wherein the biopolymer is a polynucleotide, and the aliquot is about 10 nL.

Claim 18 (withdrawn) The method of claim 11, wherein the air-drying step is conducted for a period ranging from about 5 minutes to about 60 minutes.

Claim 19 (withdrawn) The method of claim 18, wherein the air-drying step is conducted for a period of about 15 min.

Claim 20 (withdrawn) The method of claim 11, wherein a plurality of the biopolymers are placed and adsorbed on the surface of the modified substrate in an array.

Claim 21 (withdrawn) The method of claim 20, wherein the modified substrate is an amino-modified substrate.

Claim 22 (withdrawn) The method of claim 20, wherein the modified substrate is an amino-modified substrate.

Claim 23 (withdrawn) The method of claim 11, further comprising a step of exposing the assay article to a reagent.

Claim 24 (withdrawn) The method of claim 23, wherein the reagent is selected from a group consisting of: ammonium hydroxide, ethanol, and protein.

Claim 25 (withdrawn) The method of claim 24, wherein the protein is casein.

Claim 26 (withdrawn) The method of claim 1, wherein the substrate is made of polypropylene or polyethylene.

Claim 27 (withdrawn) The method of claim 26, further comprising a step of modifying the substrate surface prior to the contacting step, wherein the step of modifying the substrate comprises introduction of a functionality selected from a group consisting of: amino, carboxyl, hydroxyl, thiol, and their derivatives.

Claim 28 (withdrawn) The method of claim 27, wherein the functionality is an amino group.

Claim 29 (previously presented): A method of detecting a target biopolymer contained in a sample, comprising the steps of:

- (a) providing a substrate with a surface;
- (b) modifying the surface of the substrate by introducing a functionality selected from a group consisting of amino group, carboxyl group, thiol group, and their derivatives on the surface to obtain a modified surface;
- (c) providing a probe biopolymer that can form a complex with the target biopolymer;
- (d) contacting either the probe or target biopolymer with the modified surface of the substrate and drying the substrate whereby either the probe or target biopolymer directly adsorbs and immobilizes on the modified surface without additional fixing steps to form a probe assay article or a target assay article, respectively;
- (e) contacting the probe assay article with the target biopolymer, or contacting the target assay article with the probe biopolymer under a condition that allows the formation of a complex comprising the probe and the target biopolymers; and
- (f) detecting and determining the presence of the complex as a measurement for the presence or the amount of the target biopolymer contained in the sample.

Claim 30 (previously presented): The method of claim 29, wherein the modified surface is an amino-modified surface.

Claim 31 (previously presented): The method of claim 30, wherein the substrate with amino-modified surface is amino polypropylene.

Claim 32 (original): The method of claim 29, wherein each of the target and the probe biopolymers are selected from a group consisting of nucleic acids, polypeptides, proteins, and analogues thereof.

Claim 33 (previously presented): The method of claim 29, wherein the target biopolymer is a target polynucleotide, and the probe biopolymer is a polynucleotide that is complementary to the target polynucleotide.

Claim 34 (original): The method of claim 33, wherein the complex further comprises a reporter selected from the group consisting of dyes, chemiluminescent compounds, enzymes, fluorescent compounds, metal complexes, magnetic particles, biotin, haptens, radio frequency transmitters, and radioluminescent compounds.

Claim 35 (previously presented): The method of claim 34, wherein the biopolymer is a polynucleotide, the reporter is biotin, and the method of claim 34 further comprises a step of incubating the complex adsorbed on the modified surface of the substrate with streptavidin-alkaline phosphatase and an ELF reagent for developing a fluorescent signal prior to the detecting step.

Claim 36 (previously presented): The method of claim 35, wherein the modified surface is an amino-modified surface.

Claim 37 (previously presented): The method of claim 36, wherein the substrate with the amino-modified surface is amino polypropylene.

Claim 38 (previously presented): The method of claim 29, wherein the same or different probe or target biopolymers are adsorbed on discrete, isolated areas on the modified surface to form an array.

Claim 39 (original): The method of claim 38, wherein the detecting step comprises recording the signal with a confocal array reader.

Claim 40 (original): The method of claim 39, wherein the signal is a fluorescence and the confocal array reader is a CCD camera.

Claim 41 (original): The method of claim 29, wherein the substrate is made of polypropylene or polyethylene.

Claim 42 (previously presented): The method of claim 41, wherein the modifying step comprises aminating the surface of the substrate.

Claim 43 (withdrawn) An assay article, comprising:
substrate having a functionality selected from a group consisting of amino, carboxyl, hydroxyl, thiol and their derivatives, and
a biopolymer directly adsorbed on a surface of the substrate.

Claim 44 (withdrawn) The assay article of claim 43, wherein the substrate is in a form selected from the group consisting of foams, filaments, threads, sheets, films, slides, gels, membranes, beads, plates, and planar devices having discrete isolated areas in the form of wells, troughs, pedestals, hydrophobic or hydrophilic patches, die-cut adhesive reservoirs, or other physical barriers to fluid flow.

Claim 45 (withdrawn) The assay article of claim 43, wherein the biopolymer is selected from a group consisting of nucleic acids, polypeptides, proteins, and analogues thereof.

Claim 46 (withdrawn) The assay article of claim 45, wherein the biopolymer is a protein or a polynucleotide.

Claim 47 (withdrawn) The assay article of claim 43, wherein the substrate is made of polypropylene or polyethylene.

Claim 48 (withdrawn) The assay article of claim 47, wherein the substrate is aminated.

Claim 49 (withdrawn) The assay article of claim 47, wherein the biopolymer is polynucleotide and the substrate is in a form of a slide.

Claim 50 (withdrawn) The assay article of claim 49, wherein the length of the polynucleotide is in a range from about 20 bp to about 10 kb.

Claim 51 (withdrawn) The assay article of claim 43, wherein a plurality of the same or different biopolymers are attached to discrete, isolated areas of the substrate surface by direct adsorption to form an array.

Claim 52 (withdrawn) A test kit for detecting a target biopolymer contained in a sample comprising:

an aminated polypropylene substrate; and
a probe biopolymer directly adsorbed on a surface of the substrate, wherein the probe biopolymer forms a complex with the target biopolymer.

Claim 53 (withdrawn) The test kit of claim 52 further comprising a reporter selected from the group consisting of dyes, chemiluminescent compounds, enzymes, fluorescent compounds, metal complexes, magnetic particles, biotin, haptens, radio frequency transmitters, and radioluminescent compounds.

Claim 54 (withdrawn) The test kit of claim 53, wherein a plurality of the same or different probe biopolymers are attached to discrete, isolated areas of the substrate surface by direct adsorption forming an array.

Claim 55 (previously presented) The method of claim 29, wherein the probe biopolymer or the target biopolymer of step (c) is unmodified.

Claim 56 (previously presented) The method of claim 29, wherein the probe biopolymer or the target biopolymer of step (c) is modified.

Claim 57 (previously presented) The method of claim 29, wherein the amount of the probe biopolymer or the target biopolymer contacted with the modified surface in step (c) ranges from about 10⁻²⁰ to about 10⁻¹⁴ moles.

Claim 58 (previously presented) The method of claim 57, wherein the probe biopolymer or the target biopolymer is a polynucleotide, and the amount of the polynucleotide is about 10⁻¹⁸ moles.

Claim 59 (previously presented) The method of claim 57, wherein the contacting step (c) comprises placing an aliquot of the probe biopolymer or the target biopolymer solution on the modified surface, wherein the aliquot is from about 0.1 nL to about 500 nL.

Claim 60 (previously presented) The method of claim 59, wherein the probe biopolymer or the target biopolymer is a polynucleotide, and the aliquot is about 10 nl.

Claim 61 (previously presented) The method of claim 29, wherein the drying is air-drying conducted for a period ranging from about 5 minutes to about 60 minutes.

Claim 62 (previously presented) The method of claim 61, wherein the air-drying is conducted for a period of about 15 min.

Claim 63 (canceled)

Claim 64 (previously amended): A method of detecting a polypeptide contained in a sample, comprising the steps of:

- (a) providing a substrate with a surface;
- (b) modifying the surface of the substrate by introducing a functionality selected from a group consisting of amino group, carboxyl group, thiol group, and their derivatives on the surface to obtain a modified surface;
- (c) providing a probe polypeptide that can form a complex with the target polypeptide;
- (d) contacting either the probe or target polypeptide with the modified surface of the substrate and drying the substrate whereby either the probe or target polypeptide directly adsorbs and immobilizes on the modified surface without additional fixing steps to form a probe assay article or a target assay article, respectively;
- (e) contacting the probe assay article with the target polypeptide, or contacting the target assay article with the probe polypeptide under a condition that allows the formation of a complex comprising the probe and the target polypeptides; and
- (f) detecting and determining the presence of the complex as a measurement for the presence or the amount of the target polypeptide contained in the sample.

Claim 65 (previously presented) The method of claim 64, wherein the probe polypeptide is a protein.

Claim 66 (previously presented) The method of claim 64, wherein the target polypeptide is a protein.

Claim 67 (cancelled)

Claim 68 (previously presented): The method of claim 64, wherein the amount of the probe polypeptide or the target polypeptide contacted with the modified surface in step (c) ranges from about 10-20 to about 10-14 moles.

Claim 69 (previously presented): The method of claim 64, wherein the aliquot is from about 0.1 nL to about 500 nL.

Claim 70 (previously presented): The method of claim 64, wherein the drying is air-drying conducted for a period ranging from about 5 minutes to about 60 minutes.